The Pigeon Parlance Project

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A student laboratory procedure for teaching simple analogs of verbal behavior to pigeons is described. The three kinds of stimulus-response relations are analogs to the topography-based tact, the stimulus-selection-based tact, and receptive language. In the topography-based tact the pigeon exhibits a particular topography (pecking the left foot) when shown a particular nonverbal stimulus (a red plastic ball). In the selection-based tact the pigeon pecks a particular verbal stimulus or lexigram when shown the lexigram. In each case a set of several topographies, nonverbal stimuli, and lexigrams is involved, and food reinforcement is only received if the relation is the correct one. The procedure requires no special apparatus and can be used by students at any level.

The Pigeon Parlance Project is an effort to establish analogs of verbal behavior in pigeons. Training was initiated as part of an experimental psychology laboratory course taught by the first author in the winter of 1982, and the project is being continued by several undergraduate and graduate students in the Department of Psychology at Western Michigan University.

The primary research emphasis of the project is the development of repertoires corresponding to the elementary verbal operants as delineated by Skinner (1957) in *Verbal Behavior*. Skinner's analysis of language comprises the basic conceptual framework for the research program, although the project has been influenced in several respects by published reports of other nonhuman language training projects, and by the verbal behavior research program at the Kalamazoo Valley Multihandicap Center (Sundberg, 1980).

Apparatus requirements are minimal, and most training material can be readily constructed from available items. Training is conducted in a university classroom, with each experimental station comprised of a desktop study cubicle enclosed on three sides by wooden panels. Reinforcement in the form of mixed grain is hand-delivered and is typically accompanied by the onset of a reading lamp (mounted on the back panel of the chamber and operated by the trainer's footswitch) or by an auditory stimulus, such as a bell or a whistle. Different colored styrofoam balls and a variety of other objects have been employed as training stimuli, and verbal stimuli in the form of lexigrams con-structed from cardboard have been used in some aspect of the training.

The individual training projects currently being conducted differ in some respects, but the general interest is in establishing three basic repertoires. The first repertoire is a form of tacting, in which reinforcement is provided contingent on the pigeon's engaging in a particular response topography in the presence of a particular nonverbal stimulus. Such topographies as head thrusting (upward extension of the head and neck), foot-pecking, walking in a circle, and wing extension have been shaped, and different colored spheres approximately 1.5 inches in diameter have been used as the controlling stimulus objects. Thus, for a particular subject, this tact repertoire might consist of a head thrust in the presence of the red ball, pecking the foot when a green ball is presented, walking in a circle when shown a blue ball, and extending the wings in the presence of the yellow ball. The distinction among the various tact relations in this repertoire is based on the different response forms controlled by each stimulus object, and in this respect is analogous to the vocal tacting of human speech and to the gestural tacts of American Sign Language. Topography-based languages have been employed in various ape language projects concerned with the development of signing repertoires (e.g., Gardner & Gardner, 1967; Terrace, 1979; Fouts & Rigby, 1977; Patterson & Linden, 1981) and in the vocal tact training of an African Grey parrot (Pepperberg, 1981).

The second type of repertoire being trained is also a form of tacting, but involves

a system of verbal behavior in which the subject tacts an object by "selecting" a particular verbal stimulus from an available array of such stimuli. This type of language can be termed *stimulus-selection-based*, since the distinction among tacts in such a system involves the verbal stimulus which is "selected" from among others when a particular stimulus object is presented. The Blissymbolics system is a stimulus-selection-based language commonly employed with some nonvocal human populations. Also, the Yerkish language system (Rumbaugh, Warner, & von Glasserfeld, 1977) represents the application of this type of verbal behavior in training chimpanzees. In contrast to topography-based languages, the various tacts in a stimulus-based system are not distinctive with respect to the topographies involved, since the same form of response (e.g., pointing to a symbol, pressing a computer console key, pecking a lexigram) is common to all tact relations in the repertoire.

For stimulus-selection-based tact training, we have constructed distinctive geometric patterns on individual cardboard squares. Each black-on-white pattern is arbitrary in the sense that it does not physically resemble the object controlling the selection of that card. The lexigrams are presented in an array of verbal stimuli which can be varied in relative position across tact trials. Subsequent presentation of the object to be tacted evokes visual scanning of the array and the subject's "selection" of one of the stimuli as pecking is evoked by that lexigram. Thus, correct tacts consist of pecking a particular lexigram in the array when the green ball is presented, another lexigram when the red sphere is shown, etc. The performance is analogous to tacting in the Blissymbolics system, in which the "speaker" scans the available Blissymbols and points to or touched a specific symbol to tact a specific object or event. Such tacts are also similar to tacting in Yerkish, in which the chimpanzee locates and presses a particular lexigram on the computer console when presented with some nonverbal stimulus.

The third repertoire currently being trained in the Pigeon Parlance Project is analogous to the so-called "receptive language" training procedure, and has been termed *mand compliance with respect to a stimulus*. In this procedure, various nonverbal stimulus objects are available to the subject and the correct response is to select a particular stimulus from this array when presented with a specific verbal stimulus. For example, a child might be required to point to a picture of a dog (from among several pictures) when the trainer mands "Show me the *dog*." In the pigeon analog, the various colored balls are available on each trial, and reinforcement is presented for pecking the appropriate colored ball when each lexigram is presented.

Mand compliance with respect to a stimulus is procedurally related to stimulus-selection-based tacting. In both repertoires, the subject responds by "selecting" from among several available stimuli in an array. The topography of the "selecting" response is arbitrary and not formally differential with respect to the controlling stimulus. However, in stimulus-selection-based tacting, a particular *verbal* stimulus (lexigram) is selected (pecked in the present case) when a particular nonverbal stimulus is shown. In mand compliance with respect to a stimulus, the pigeon pecks a particular *nonverbal* stimulus when a verbal discriminative stimulus is presented.

Both tact repertoires being trained correspond to Skinner's (1957) definition of the tact relation in that a nonverbal discriminative stimulus evokes a verbal response on the part of the "speaker." Skinner has pointed out that "pure" tacts are of greatest practical benefit for the listener, since in such tact relations the form of the verbal response is controlled exclusively by the nonverbal stimulus and not by any establishing operation related to a specific form of reinforcement provided by the listener. In the case of human speech, tacts are generally "freed" from control by specific establishing operations through the use of generalized conditioned reinforcement, but such reinforcement is not a necessary or defining feature of the tact relation. In the Pigeon Parlance Project, correct tacts are consequated with food presentation and/or a form of nongeneralized conditioned reinforcement (the light onset or the bell correlated with grain presentation). However, these tact repertoires constitute valid tact relations in that food deprivation and food reinforcement control neither the form of response in the topography-based language nor the particular stimulus selected

in the stimulus-selection-based repertoire. The form of reinforcement and the relevant establishing operation no doubt affect the pigeons' general tendency to tact, but cannot provide for differential control of particular tact responses in either procedure.

The distinction between topography-based and stimulus-selection-based languages would appear to be a useful one in the design and interpretation of verbal behavior research, and several aspects of this distinction seem noteworthy. In a topography-based language (such as speech or signing) there is a unique point-to-point correspondence between the form of the response and the pattern of stimulation produced by that response. This correlation between the form of the response and its product is not a feature of stimulus-selection-based languages, since the selection response is topographically similar for all verbal relations in the repertoire. Furthermore, in a topography-based system the controlling variables evokes a specific form of response, while in the stimulus-selection-based language the form of the selecting response is nonspecific in its relation to the stimulus which evokes it. Finally, in topography-based languages the controlling variables evoke a given response form, while the controlling relation in stimulus-selection-based language is necessarily multiple in nature. In stimulus-selection-based tacting, for example, the presentation of the nonverbal S^D evokes scanning of the array of stimuli, one of which evokes the "selecting" response. Correct responding in such a system can occur only if the selection response is thus multiply controlled by the relevant controlling variable and by the location of the particular stimulus in the array. This type of control is not an inherent feature of topography-based languages.

Training of the three repertoires described above permits investigation of other verbal operant analogs in pigeons. For example, Skinner (1957) defined the intraverbal relation as a verbal response evoked by a verbal stimulus which does not correspond in a point-to-point fashion with the form of the response. In the pigeon analog, topography-based intraverbal relations would consist of the pigeons engaging in a specific form of response when presented a particular lexigram. For example, given training in the repertoires described above, the bird could respond intraverbally by engaging in the same topography as had been evoked by the red ball (in the previous tact training) when the lexigram for the red ball is presented. A stimulus-selection-based form of intraverbal behavior would be demonstrated by the pigeon's pecking a particular lexigram when shown, for example, another pigeon engaging in the topography appropriate to a colored ball. Duplic behavior, in which the response-product corresponds in a point-to-point manner and is physically similar to the controlling verbal stimulus (Michael, 1982a), would consist of the pigeon's engaging in the same form of response or selecting the same lexigram as another pigeon (or a cloth "pigeon surrogate").

A pigeon analog of manding, in which the verbal response is controlled by the characteristic form of reinforcement for the response, or by the establishing operation relevant to that form of reinforcement (Michael, 1982b), might be established by first developing a series of tasks, each of which requires some object or event for completion and access to reinforcement. The subject might then be required to mand the necessary missing item (by engaging in a specific topography or by selecting a particular lexigram) when presented with the other aspect of the task situation. A pigeon might be trained to roll a ball into a cup, stand on a block to peck a bell, and pull a chain to open a food compartment. When the cup alone is presented, the pigeon would be required to engage in a specific topography or select a particular lexigram prior to being given the ball and allowed to complete the task. Comparable mands for the block or the chain also could be trained by presenting the bell or the food compartment without the necessary "tools" for completing those tasks.

As a program of research the Pigeon Parlance Project has several desirable features. Subjects are easily acquired, are inexpensive to house and maintain, and have a sufficient life expectancy in laboratory settings to permit relatively extended training and the development of lengthy experimental histories. Specialized and costly research apparatus is not required for the procedures described above, and training materials can easily be obtained or constructed from a variety of commonly available items. The

number of potential stimulus objects which can be utilized is very large, as the number of different lexigrams which could be constructed for use in the stimulus-selection-based language training. Although the range of possible topographies for pigeons is somewhat constrained, the number of formally distinct responses which can be developed as a basis for a topography-based system of verbal behavior is certainly sufficient for a limited repertoire of this type and can be maximized by careful shaping.

In addition, the project appears to provide some additional contingencies for the scientific behavior of the trainers. Current individual projects differ from one another in one or more aspects, and yet each researcher is in frequent contact with other trainers whose projects are thematically integrated and whose data are therefore of direct and continuing relevance and interest. Furthermore, the project's participants comprise a community of researchers who reinforce each other's verbal behavior about verbal behavior and who support a common interest in the behavioral analysis of language.

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